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Automated Neuropsychological Assessment Metrics (ANAM) Traumatic Brain Injury (TBI): Human Factors Assessment

by Valerie J. Rice, Gaylord Lindsay, Cory Overby, Angela Jeter, Petra E. Alfred, Gary L. Boykin, Carita DeVilbiss, and Raymond Bateman

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Army Research Laboratory

Aberdeen Proving Ground, MD 21005-5425

Automated Neuropsychological Assessment Metrics (ANAM) Traumatic Brain Injury (TBI): Human Factors Assessment

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14. ABSTRACT

The purpose of this human factors assessment is to identify the human use issues associated with using the Neuropsychological Assessment Metrics (ANAM). This report is one, in a series of three reports, examining the human factors issues associated with technologies being investigated for their potential to assist with identifying individuals who may have incurred a Traumatic Brain Injury (TBI). The Automated ANAM is widely used pre and post deployment in an effort to both establish a neurocognitive baseline and to evaluate returning military service members for signs and symptoms of TBI. The ANAM is comprised of approximately 30 modifiable, automated, and largely self-administered test components used to assess memory, attention, concentration, learning, information processing, problem solving, general intellectual skills, sleepiness and mood. Respondents use a PC with a normal keyboard and mouse to input exam answers.

15. SUBJECT TERMS

ANAM, human factors, TBI

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1. Introduction

1.1 Background

Traumatic brain injury (TBI) is considered a signature wound of the current conflicts in Iraq and Afghanistan primarily due to the increased use of explosive weapons, such as improvised explosive devices (IEDs). However, mild TBI (mTBI) is difficult to diagnose since it is typically a closed head wound and symptoms may not be sufficiently extreme for the service member and his or her supervisors and co-workers to discern an injury has occurred. Additionally, some service members who are determined to accomplish their mission and feel a strong desire to remain in-country and support their unit, may mask their symptoms (e.g., cognitive deficiency, chronic daily headaches) by simply not seeking care. The motivation not to leave one's fellow service members behind is strong, even when an individual has been injured, and perhaps even more so when the injured service member is uncertain whether their injury is real or an imagined set of symptoms related to stress. Undiagnosed mTBI can endanger not only the individual, but also the entire unit. A Soldier's cognitive as well as physical and emotional deficits may not be evident until a mistake is made that could put both the service member and his or her team in jeopardy. Diagnostic technology that can be fielded with the troops could enhance the detection of mTBI and potentially save lives.

1.2 Objective

The objective of this technical note is to provide human factors information and feedback on the use of the Automated Neuropsychological Assessment Metrics* (ANAM®) software to those who operate and sustain the ANAM, so they may make alterations and updates as appropriate. The information for this technical note was collected during data gathering for the research protocol entitled "The Investigation of Emerging Technologies for Use in Screening for Traumatic Brain Injury" (HPRO Log Number A-15155). Suggestions for consideration in developing future ANAM generations are offered, with an emphasis on the military operating environment. This report does not include information on the effectiveness of the ANAM in identifying who does or does not have a mTBI, that information will be published in a subsequent report.

1.3 Overview

The ANAM is a computer-based test system for assessing human performance and neuropsychological function. The ANAM is one of four technologies evaluated under the protocol (HPRO Log Number A-15155) "The Investigation of Emerging Technologies for Use in Screening for Traumatic Brain Injury" with the purpose of examining methods to assist in

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identifying Soldiers with a mTBI. Initial testing (under this protocol) began on 27 January 2009 and was completed in May 2010. All data was gathered at Brooke Army Medical Center, Ft. Sam Houston, TX, in the TBI Clinic. The research protocol involved a double blind study in which research team members collecting data were unaware of the volunteers' diagnostic status. Six researchers collected data, while two unblinded researchers collated the data. Ninety-six (96) volunteers were screened for TBI and Post Traumatic Stress Disorder (PTSD) by TBI clinical staff (physicians, nurse practitioners, and physicians assistants) and annotated in one of four categories based on diagnostic results: (1) TBI only, (2) PTSD only, (3) Both TBI and PTSD, and (4) Neither condition.

During data collection and volunteer assessments, annotations were made of human factors issues that arose. This document is the result of those notations and has been prepared expressly for those involved in the development and sustainment of the ANAM. It is hoped that this information will assist in updating the product and the user manuals for other researchers who choose to use the ANAM as part of a research protocol.

1.4   Terminology

Automated Neuropsychological Assessment Metrics (ANAM). The acronym ANAM is used to refer to the Automated Neuropsychological Assessment Metrics. The ANAM is a computer-based test system for assessing human performance and neuropsychological function (see figure 1). It consists of a library of 30 tests, collated into a number of distinct batteries for specific purposes. For the purposes of this report, the term 'ANAM' will be used to refer to the ANAM4 TBI battery unless otherwise noted.

Subject. The term 'subject' is used to refer to the person who is being monitored. This convention is used since this Human Factors Assessment was conducted in conjunction with the research protocol focused on the technology. In literature prepared by the vendor or others who may have used this system, this person is referred to as the 'patient' since it is typically used within a clinical setting. The terms 'participant,' 'volunteer,' and 'user' may be utilized as well.

ANAM Data Extraction and Presentation Tool (ADEPT)[†™]. ADEPT refers to the software application associated with the ANAM test, which allows for managing and viewing session data files produced by the ANAM test.

ANAM Performance Report (APR)[*™]. APR refers to the software application associated with the ANAM test, which allows for printing and viewing reports for particular ANAM test sessions.

[†] ADEPT and ANAM Performance Report (APR)[*] are both intellectual property owned by United States Government, licensed to University of Oklahoma (C-Shop) Norman, Oklahoma 73072.

1.5   Automated Neuropsychological Assessment Metrics (ANAM)

The ANAM is a computer-based test system for assessing human performance and neuropsychological function, such as speed and accuracy of attention, memory, and thinking ability. It was initially developed from the Unified Tri-Service Cognitive Performance Assessment Battery (UTC-PAB). The ANAM was specifically designed for the Department of Defense (DoD) to meet the objectives of having a test battery for repeated measures (Reeves et al., 2007). The TBI version of the ANAM, ANAM4 TBI, has the advantage of being built upon previous data from participants diagnosed with traumatic brain injuries (Bleiberg et al., 2000; Levinson and Reeves, 1997). The main difference between the ANAM4 TBI and the ANAM4 is not in the presentation or types of tests administered but in the features of the Performance Report that enables ANAM4 TBI to be easily integrated with DoD medical records (Center for the Study of Human Operator Performance [C-SHOP], 2008). The ANAM4 TBI consists of eight tests listed in table 1 along with demographics and TBI questionnaires.

Table 1. ANAM4 TBI test and function list.

Test List	Domain / Function
Demographics	User profile
TBI questionnaire	TBI history
Sleepiness scale	Fatigue
Simple reaction time	Basic neural processing (speed/efficiency, emphasis on motor activity)
Code substitution-learning	Associative learning (speed/efficiency)
Procedural reaction time	Processing speed (choice RT/rule adherence)
Mathematical processing	Working memory
Matching to sample	Visual spatial memory
Code substitution–delayed	Memory (delayed)
Simple reaction time (R)	Basic neural processing (speed/efficiency)

1.6   Test Configuration

The ANAM battery was installed onto a Dell Latitude D820 laptop computer. The laptop utilized the Microsoft[‡] (MS) Windows[§] XP operating system with 1 GB of RAM, an 80 GB hard disk drive and a 1.83 GHz processor. A listing of the required specifications for using the ANAM software is listed in appendix A. Figure 1 illustrates the ANAM-TBI computer screen Launchpad after installation is complete.

[‡] Microsoft is a registered trademark of Microsoft Corp. in the United States and/or other countries.

[§] Windows is a registered trademark of Microsoft Corp. in the United States and/or other countries.
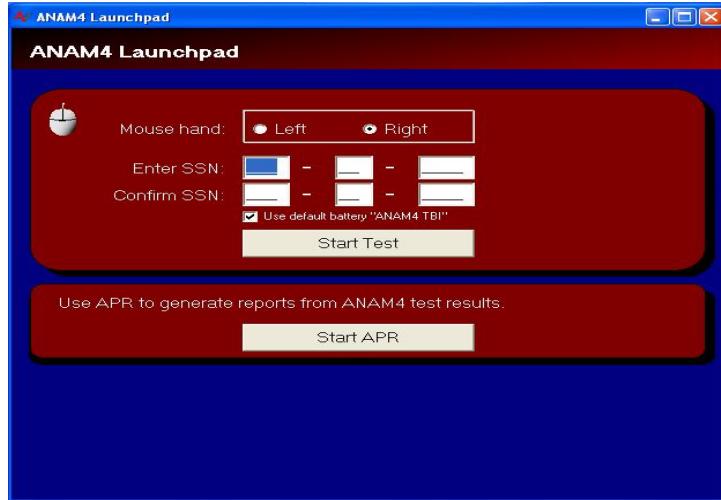
Figure 1. ANAM launch screen.

2.   Technology Assessment

The information in this technical note is based on researchers recording their observations of the ANAM during data collection. Consideration was given to the ANAM's ease of use, intuitiveness of operation, and operation performance.

2.1   Set-Up and Testing Considerations

The ANAM software was installed onto a laptop PC. Most standard input devices are supported by the ANAM, including universal serial bus (USB) mice and keyboards, and serial mice, however Microsoft or Logitech[**] input devices are recommended by the manufacturer. When using laptop computers, internal keyboards are sufficient for most ANAM test modules, but the use of external input devices is recommended by the manufacturer when practical. The core ANAM software requires approximately 25 MB of disk space. However, due to data storage requirements and to ensure optimal performance, 150 MB of free space is recommended. `The core ANAM software has been designed for use on IBM compatible computer systems equipped with Windows 95/98 or higher. The ancillary support products (ADEPT/APR) require Windows 98 or higher as well as MS .NET Framework v2.0 or higher versions.

2.1.1 Testing Environment

The ANAM takes approximately 30 min to complete. Test subjects readily reported uncomfortable climate and conditions. Having a comfortable environment, without distractions, enables subjects to concentrate on completing the task, rather than focusing on environmental discomforts or disturbances. Therefore, the following are suggested:

[**] Logitech is a registered trademark of Logitech Corporation.

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- Comfortable room temperature

- Well ventilated room

- Quiet environment, free of noise and interruptions

- Clean, uncluttered work environment with ample space for the laptop and external control devices (mouse, keyboard)

- Adequate illumination: Many subjects preferred dimmed lights to reduce glare on the computer screen.

- Seating:

  - Comfortable

  - Permit subjects to sit without having their back to the door: Most subjects expressed a preference not to have their back facing the door or entrance of test taking area (the utilized room had only one entrance/exit).

In addition, symptoms of TBI include headaches and sensitivity to light and sound. Therefore, if the subject taking the ANAM has a possible TBI diagnosis, an effort should be made to provide a quiet, relatively private environment with low lighting for testing.

2.2 Portability

In addition to laptops, the ANAM can be installed on desktop PCs, if the system meets the installation requirements. The software was not assessed for compatibility with other portable devices such as netbooks, cellular phones, or other handheld computers. The portability of the ANAM is only limited by the portability of the device upon which it is installed.

2.3 Power Requirements

The ANAM was installed on a Dell Latitude D820 laptop computer. The laptop utilized a Dell PA-10 Family A/C adaptor rated for 100 v–240 v input with a 19.5 v output and one 3 v self-contained DC Li-ion rechargeable battery. The battery lifespan is 4 h under normal operating conditions and recharge time is approximated 6 h to full capacity. The battery should not be exposed temperatures exceeding 60 °C.

2.4 Training Requirements

The ANAM manual stipulates the test administrator should have sufficient practice prior to actual performance testing. For the purpose of this study, data collectors familiarized themselves with ANAM before administering the ANAM to study participants. Familiarization with proper procedures was accomplished within 20 h over 2 work weeks, and consisted of reviewing administration procedures, taking the assessment multiple times, accessing, viewing, and printing session reports, and opening/saving/exporting performance data files. Note that interpretation of

the data, beyond the raw data or information automatically generated, requires both training and clinical credentialing. No clinical interpretations were rendered during this evaluation. In order to print assessments of volunteer or patient sessions, the researcher must utilize an ancillary program (APR). For research purposes, raw data from sessions may need to be extracted and imported into a spreadsheet. Instructions to perform this task can be found in the ANAM manual provided by the manufacturer. However, some problems were encountered during this process, which is detailed in section 2.6.

2.5   Ease-of-Use

Ease-of-use of the ANAM was qualitatively determined by the data collectors based upon their experience using the software. No formal measurement instrument was employed for measuring the ANAM's ease of use.

Overall the ANAM was not difficult for researchers to administer or for subjects to use. The ANAM's graphical user interface is simple, straightforward, and easy to use and understand. The researchers and test subjects were familiar with similar types of software such as MS Windows-based products. Providing adequate instructions to the subject, in addition to a comfortable atmosphere makes the use of this software easy and free flowing. The ANAM has specific screen instructions and audible tones to assist when consistent errors occur. This built-in feature enables the observer and the subject to remain on track for the intended task.

The ANAM has one feature that was unfamiliar to the users. If a participant presses the mouse button too often and too fast, an auditory beep is emitted, the program will stop running, and the participant is forced to restart testing. None of the previous information is saved. This feature required another addition to the participant instructions for the current study. Some participants voiced frustration with being forced to start over, which could have influenced their subsequent performance (however, this is speculative and based solely on the comments of some participants who were forced to repeat the battery).

The library of tests and batteries in the ANAM range from simple response-time measures to more diverse measures of attention, memory, executive functioning and spatial, language, and motor ability (see appendix B). Its strengths include a decade's long record of use and direct linkage, for performance comparisons, to the archival research literature. It can be economically and efficiently administered in a variety of settings, including field settings, and is currently being used in studies to provide base-line cognitive data on Warfighters deployed to Afghanistan and Iraq (for example, Vasterling et al., 2006). It can be used on a desktop, laptop, handheld units, local area network (LAN) or wide area network (WAN) test systems. It uses a mouse and limited number of keys for responses. Tests in ANAM can be configured in a variety of ways. This feature is significantly useful since each ANAM test battery measures different cognitive and motor abilities; if necessary, tests can be designed for specific patients. Test parameters are controlled by "Command line switches" that specify items such as the number of stimuli presented, the size, color, and type of stimuli used, and the control of inter- and intra-stimulus

intervals. The menu list file is an ASCII text file that is read by the "master" program, "A2_Menu.exe," which runs the test battery. This design allows the construction of customized batteries using a text editor such as MS Notepad.

In the Profile of Mood States, the subject selects their predominant mood state in seven subcategories, using a scale ranging from 0 to 6. The 0 has a verbal anchor of "not at all," the midpoint 3 is anchored as "somewhat," and 6 is anchored as "very much." After each response, the computer re-centers, so the response of the participant must be to the right or left of the center response. A few participants expected their last response to have remained, thus requiring them to move, not from the center, but from their own last key stroke. Thus, the instructions must be clear to the participant, reminding them that the computer will re-center and their responses must move up (toward the higher end of the scale) or down (toward the lower end of the scale) from that center point.

2.6   Exporting ANAM Data

Exporting ANAM data requires multiple, somewhat cumbersome steps which were necessary to extract variables of interest for the current study. However, for transfer of smaller amounts of data for individual participants, the procedure is accomplished in much fewer steps using the default setting.

For this study, data from each subject, session, and run were copied from the 'ANAM data' folder to a 'ANAM data-all trial completed' folder, located on the hard drive of the local machine within the ANAM directory. For research purposes, the data then had to be exported using the ANAM wizard as tab and comma delimited data onto a spreadsheet. Once the data was exported into a spreadsheet, it was inspected and organized. For the current study, some variable titles were adjusted in MS Excel to conform to the Statistical Package for the Social Sciences (SPSS) dataset label limitations. This process is explained in greater detail in the procedural guide (appendix C). Repeats of the subject number, run and session were removed and the data was reordered to conform to the SPSS data set. Such specifics will be required of a study in which the ANAM is used to record full data for analysis. This attention to detail might be eliminated by creating an automatic function to export data to a data file into a spreadsheet either in MS Excel or compatible statistical analysis program. Of course, such an export program would certainly need to compile data collected from subjects tested over time.

2.7   Printing Reports

After a subject has finished taking the ANAM, reports can be brought up with the browser, converted to a PDF file and printed.

If files are moved to ANAM data-all trial completed folder (rather than a second copy being created) before the report is printed, the folder indicated for the browser to search for the subject's data must also be changed. That is, one can no longer go to the original data file to

print the report. While this seems intuitive, it is an easy mistake for a researcher to make during the early phases of data collection.

3.   Limitations and Considerations

There are some factors that were encountered that may have affected the outcome of participants' test results and use of the ANAM. This section will address such issues and how they were subsequently addressed.

3.1   Environmental Factors

As stated previously, testing should be conducted in a low traffic, quiet environment to enable the participant to concentrate solely on the assessment and not be distracted by the surroundings. This is especially true for participants who may be experiencing distress or anxiety. Participants who reported being under notable stress or having difficulty concentrating took longer to perform the assessment and generally their initial performance was poorer, in comparison to later sessions. For each participant visit the ANAM was administered twice. That is, an initial session was necessary for them to become familiar with the ANAM testing procedure and testing environment. We addressed environmental conditions by: (1) creating a quiet, calm environment (as much as possible in a clinic area), (2) monitoring the subject, assessing if they needed environmental changes and adjusting the environment upon request (e.g., dimming the lighting, closing the door slightly), (3) asking the participant if he or she needed a break before starting the session (e.g., to relax, use the restroom), (4) monitoring the subject and talking to them calmly—giving them a chance to relax and feel secure before beginning the test session. In cases where the subject was tired or sleepy, monitoring them during testing and assisting verbally by asking if they were "doing okay" in order to stay awake and on task was helpful. Only the second ANAM test was used for data analysis. There is no evidence of ANAM familiarization affecting performance; however, a certain degree of the learning curve effect should be expected.

As previously mentioned, bright lighting in the testing area made it difficult to view the PC screen and instructions. Repositioning the screen or the placement of the computer system and testing for glare is beneficial. Future administrations may benefit from the use of a filter to reduce glare upon the computer screen.

3.2   Unexplained Missing Graphics and Session Data

When utilizing ANAM APR to open a test session and produce a printable report, it was encountered that graphics did not appear and only the standard red "X" placeholder for the Summary Performance Indicator image appears (figure 2). This happened often. The important graphic that does not appear is the summary performance indicator that gives an overall ANAM

performance score for the subject (figure 3). The problem was addressed by exiting out of APR, restarting the application, and then reopening the test session. Upon reopening the session the graphics then appear as they normally should (figure 4). The next generation of ANAM should be able to address this issue.
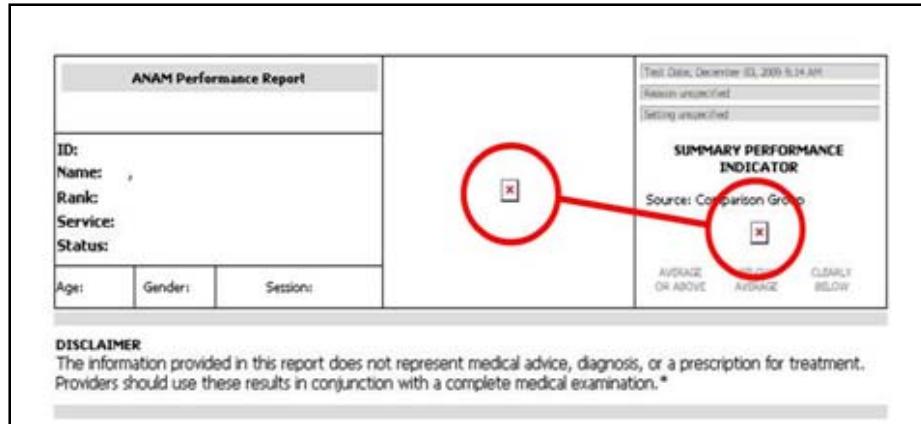

Figure 2. Missing graphics.

Figure 3. Summary performance indicator.
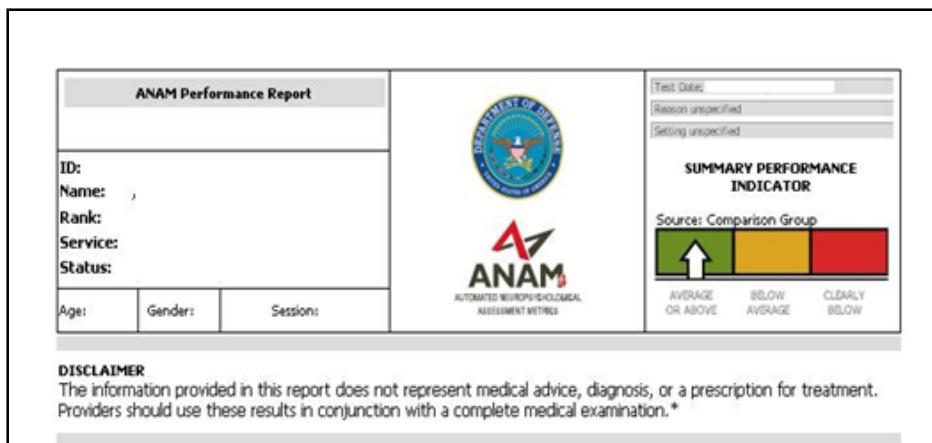
Figure 4. Graphics present.

One occurrence of unexplained missing data was encountered during the course of the study. A participant completed their ANAM session and within the hour an attempt was made to retrieve that session data. Inexplicably, the session data was not found in the designated default folder for the given session, nor was it found in any other folders. This problem was only encountered once during the course of testing and was not investigated further. This should have been an 'automatic save' and should have been recorded somewhere on the hard drive.

3.3   MS Excel Column Capacity

When exporting ANAM data into MS Excel a problem was encountered with versions of Excel prior to Excel 2007. While utilizing MS Excel 2003 to import ANAM data, a problem arose in which the amount of data exceeded the maximum number of columns (256) Excel could produce. This problem was not serious as the information that could not be included was not essential to this study. Other researchers may find this to be an issue if the required information falls into this cut off point. The problem can be avoided by utilizing MS Excel 2007 and later versions. MS Excel 2007 and 2010 possess an increased number of maximum columns allowed (16384).

3.4   Excessive Test-Taker Errors

The ANAM test battery restricts the time an individual can take to complete each item. While this was not a problem with subjects completing the battery too slowly, it was a problem with those who were very quick in their responses. In addition, if too many errors are made or the responses are entered "too quickly," the test will stop (freeze) and the participant will be required to start over from the beginning of the test. None of their original entries will be saved. Some participants expressed frustration when this occurred. It is not known whether their frustration impacted their subsequent scores. After this occurrence was brought to the attention of the data collectors, researchers included this as part of their initial instructions to subjects (not to react "too quickly" and to read/listen to instructions carefully to minimize errors, to avoid an unnecessary restart). Note that "errors" are not the same as incorrect responses to a question.

4.   Conclusion

Overall the ANAM is easy to install, administer, and retrieve information. The application itself conforms to contemporary MS Windows OS functions and appearance, which many people are accustomed to. The ANAM has the advantage of familiarity within the military as it is widely administered to units as part of pre-deployment procedures (U.S. Army Medical Department, 2010; Reeves et al., 2006). Many participants within the current study made it known to the researchers they had previously taken an ANAM. Others had not taken the ANAM but were nonetheless aware of it. The ANAM provides advantages over traditional paper tests with

portability and expediency of available results and has been found to have equivalent reliability to similar traditional neuropsychological tests (Jones et al., 2008).

Installation of the ANAM is simple and similar to most other contemporary software packages. The auto install feature requires little effort and only a license key is needed (accompanied with the software) to make the software active, also similar to most contemporary software packages. Administration of the ANAM TBI is not difficult and the directions are direct and easy to understand. The test requires little instruction for the users to take the assessment, or for researchers to administer. Researcher familiarization with administration procedures only requires a small amount of time, 20 h within 2 weeks.

Suggested changes include easier exportation of data to files for data analysis, inclusion of response speed in the instructions to participants (or altering response speed allowed to permit users who are exceptionally quick to respond normally), and taking the possible diagnoses of participants into account. The latter requires controlling the environment for light, sound, and other distractions as well as slight alterations in the instructions and monitoring of participants. In addition, the loss of graphics (described in section 3.2 of this document) should be corrected via software changes.

These few changes will improve the utility of the ANAM for research purposes. This will be an advantage as the military commonly employs neuropsychological evaluations for baseline assessments and for patient treatment, post suspected TBI (Brenner et al., 2010), and the ANAM has been undergoing examination for usefulness in screening for TBI (Ivins et al., 2009; this study: protocol HPRO Log Number A-15155 "The Investigation of Emerging Technologies for Use in Screening for Traumatic Brain Injury").

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Appendix A. Technical Specifications—NAM Requirements

Name: Automated Neuropsychological Assessment Metrics 4-TBI

Operating System: MS Windows 95/98, NT4, 2000, XP, and Vista. ADEPT/APR requires MS Windows 98 or higher

Chipset: Intel Pentium 90MHz or greater

RAM: 32 MB or more

HDD: 25 MB of disk space; 150 MB of free disk space is recommended. ADEPT/APR requires 50 MB of disk space, 300 MB of free disk space is recommended.

Input Devices: Standard keyboard and PS/2 mouse. Wireless devices are not recommended.

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Appendix B. ANAM Test Library

Table B-1. ANAM tests and functions

Test List	Domain/Function
Demographics	User profile
TBI questionnaire	TBI history
Sleepiness scale	Fatigue
Simple reaction time	Basic neural processing (speed/efficiency, emphasis on motor activity)
Code substitution–learning	Associative learning (speed/efficiency)
Procedural reaction time	Processing Speed (choice RT/ rule adherence)
Mathematical processing	Working memory
Matching to sample	Visual spatial memory
Code substitution–delayed	Memory (delayed)
Simple reaction time (R)	Basic neural processing (speed/efficiency)

Figure B-1. Demographics module.

For the current study the participants were only referenced by an assigned number for their ID. Apart from this only age and sex were recorded in the ANAM demographics section.

Figure B-2. Sleep scale (provides a state and/or trait assessment of energy–fatigue level).

Figure B-3. Mood scale (access either mood state or trait).
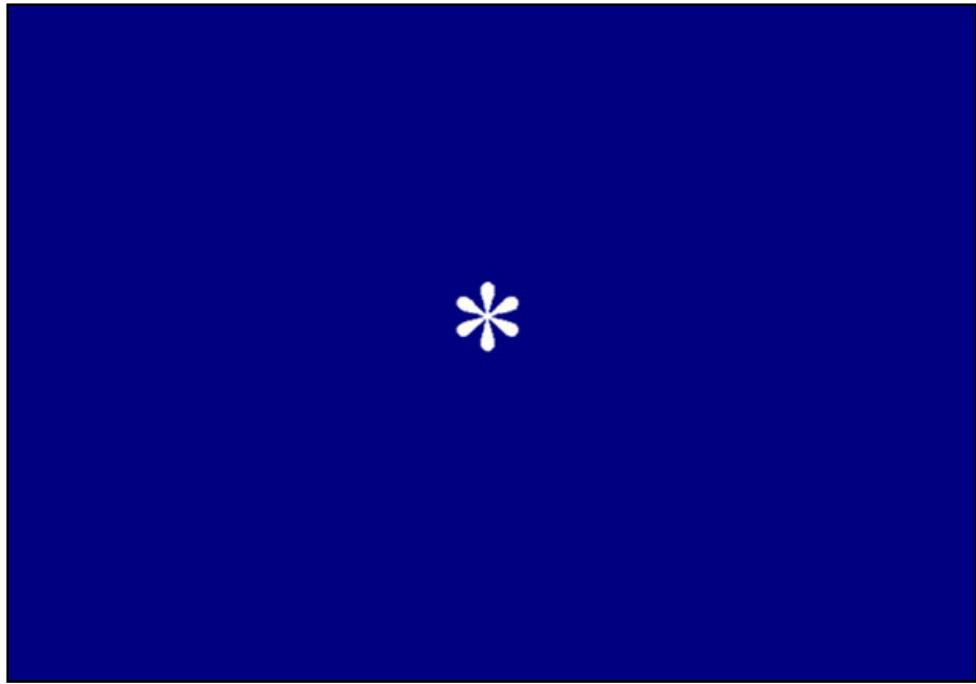
Figure B-4. Simple reaction time (index of visuo–motor response).
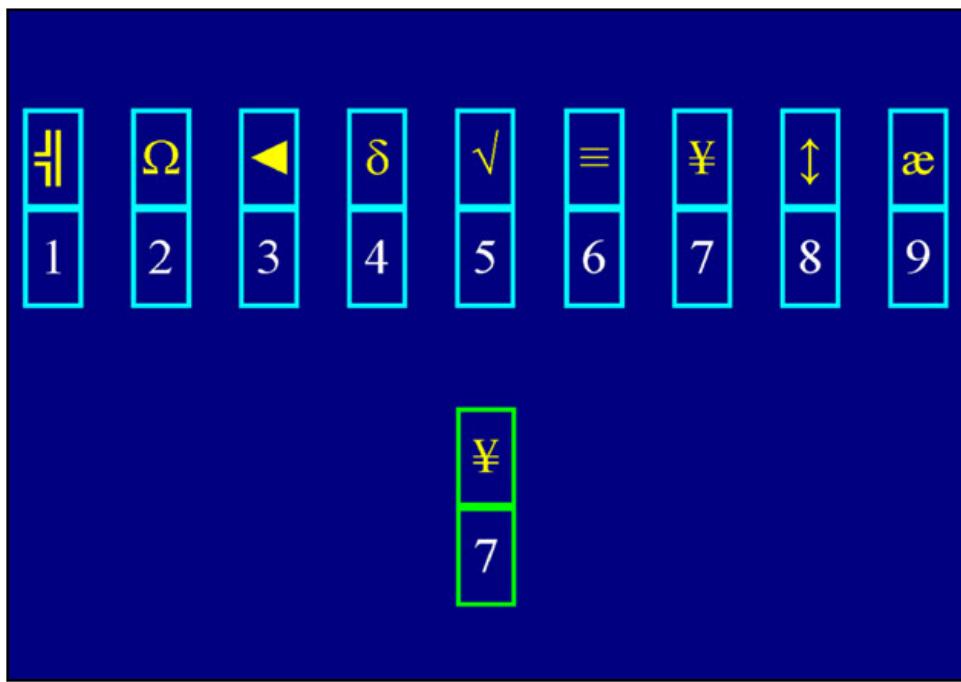
Figure B-5. Code substitution–learning (index of visual search, sustained attention, and encoding).
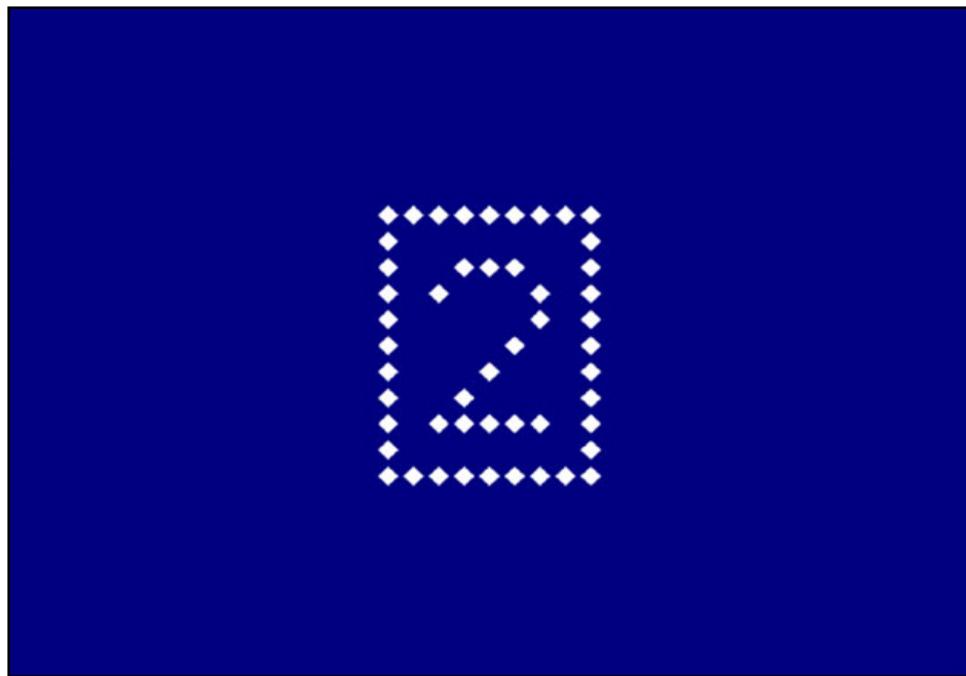
Figure B-6. Procedural reaction time (measures reaction time and processing efficiency).
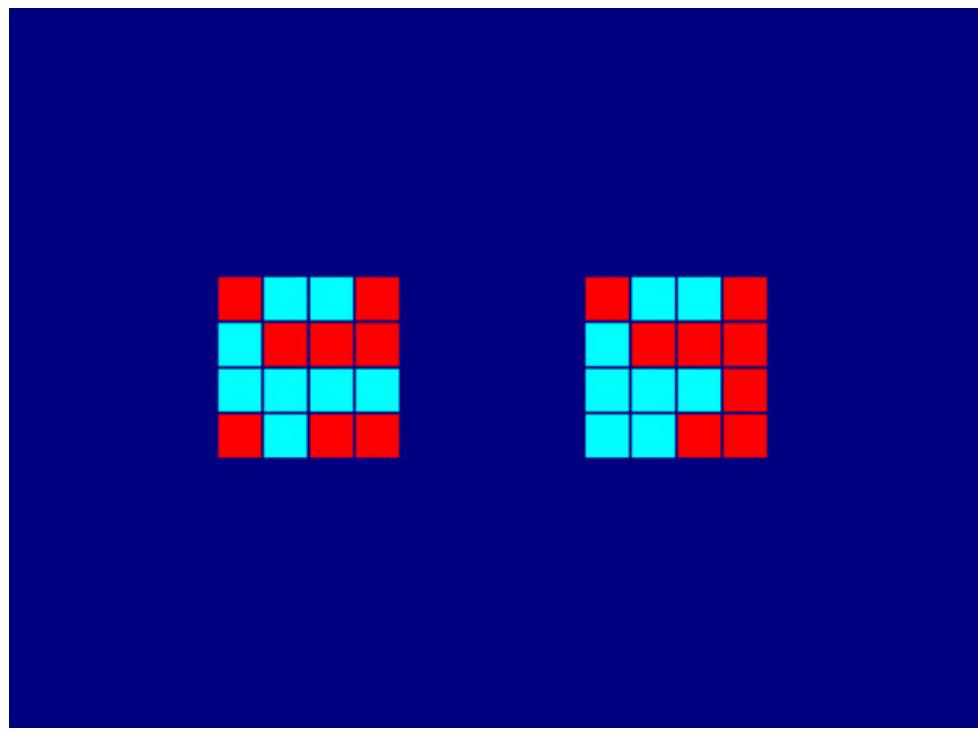
Figure B-7. Matching to sample (index of spatial processing and visuo–spatial working memory).
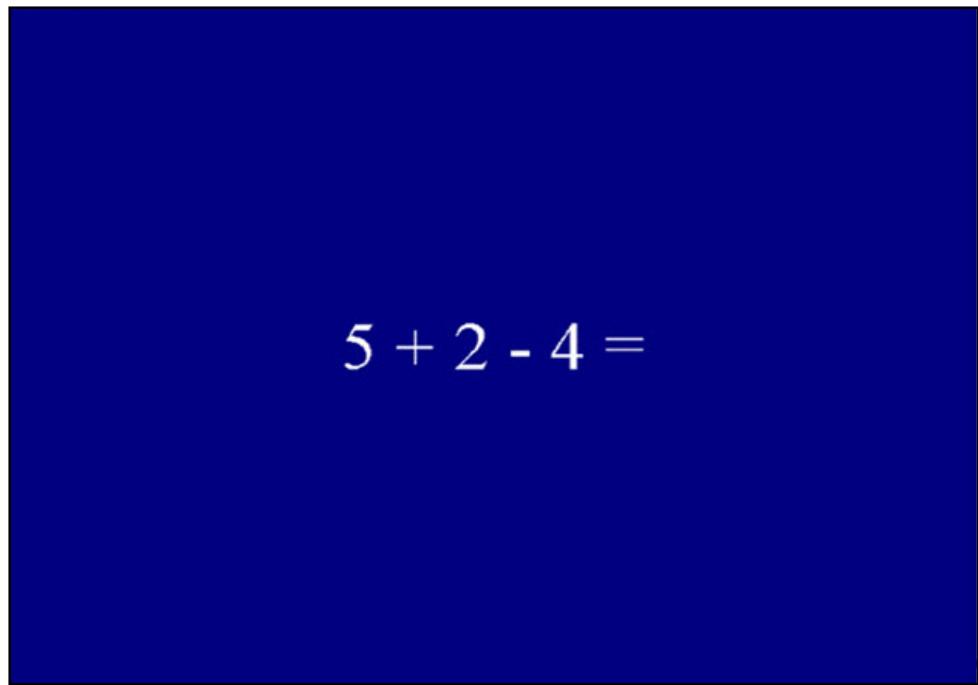
Figure B-8. Mathematical processing (index of basic computational skills, concentration, and working memory).
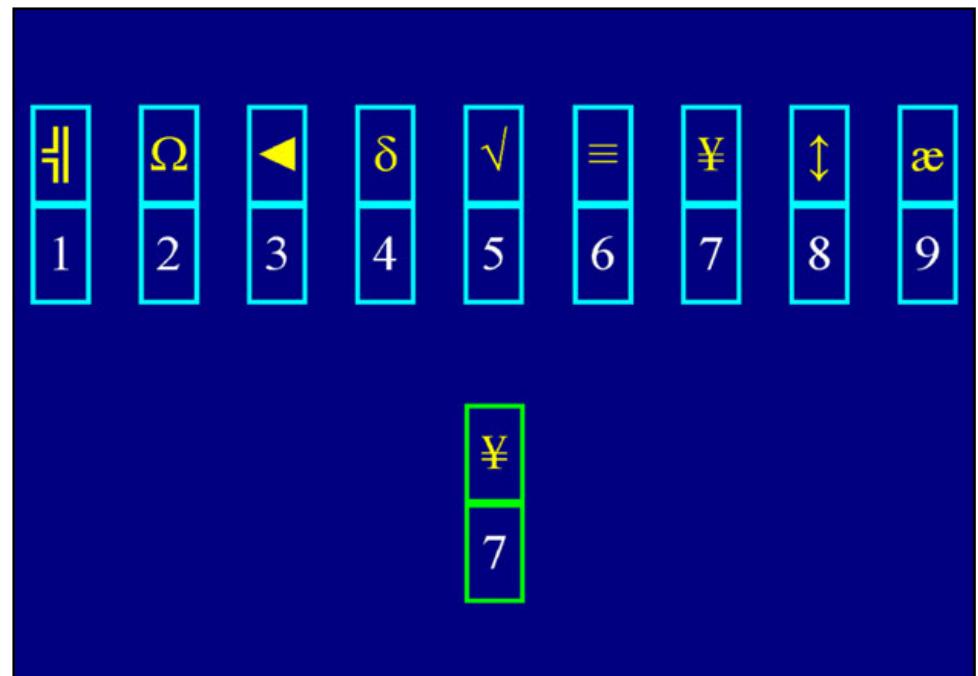
Figure B-9. Code substitution–delayed (index of delayed memory).

Data output

All tests within the ANAM system produce a series of scores including: (1) percent correct, (2) mean response time for all responses, (3) mean response time for correct responses, (4) standard deviation of the mean response time for all responses, (5) standard deviation of the mean response time for correct responses, (6) median response time for all responses, (7) median response time for correct responses, (8) throughput (calculated number of correct responses per minute), (9) response omissions, and (10) premature responses (less than 130 ms).

Appendix C. Data Transfer Procedures

ANAM™ DATA TRANSFER INSTRUCTIONS

I. MOVING DATA- USING THE ANAM™ COMPUTER

1. **Double click on "MY COMPUTER"**
2. **Click on "LOCAL DISK C"**
3. **Open "ANAM™DATA"**
4. **Minimize "ANAM™DATA"**
5. **Double click on "MY COMPUTER" again**
6. **Click on "LOCAL DISK C" again**
7. **Open "ANAM™DATA2"**
8. **Go back to "ANAM™DATA" cut all completed subjects from list and paste into "ANAM™DATA2" (highlight subject you wish t cut and hold shift key to choose entire row, using mouse to select all files/subject)**

II. SECTION FORM – PAGE 1

1. **Double click on "ADEPT(2)"**
2. **Click on "FILE"**
3. **Click on "NEW SUMMARY VIEW"**
4. **Pop up window will appear, "BROWSE FOR FOLDER" choose "ANAM™DATA2 – ALL TRIALS COMPLETED"**
5. **Click "OK"**

This appendix appears in its original form, without editorial change.
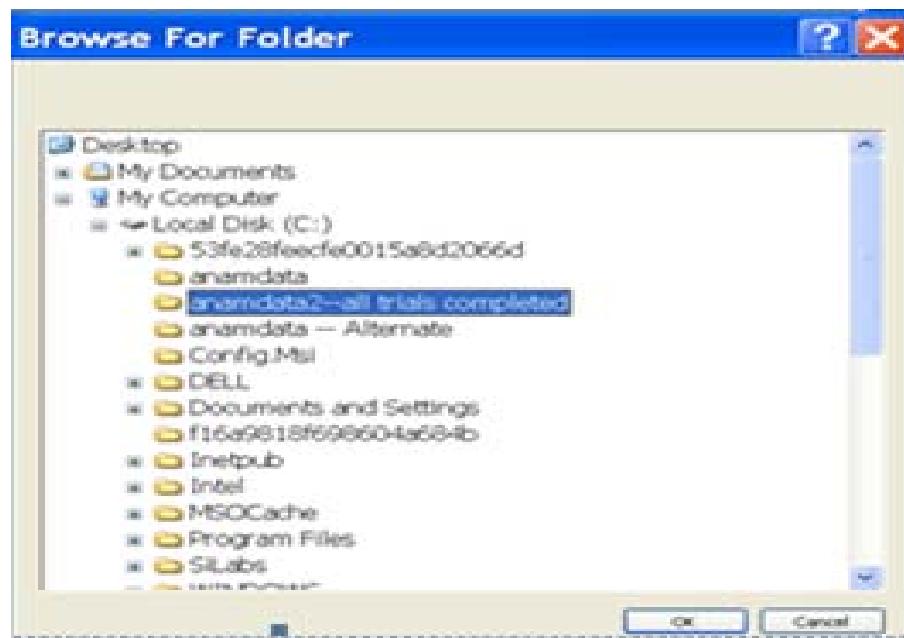
1. Pop up window "SELECTION FORM – PAGE 1" choose subject ID number you wish to view and retrieve (to choose a series of subjects hold down shift key, to choose individual subjects use the Ctrl key)
2. Select "ALL" under Test
3. Select "ALL" under Sessions
4. Click "NEXT"
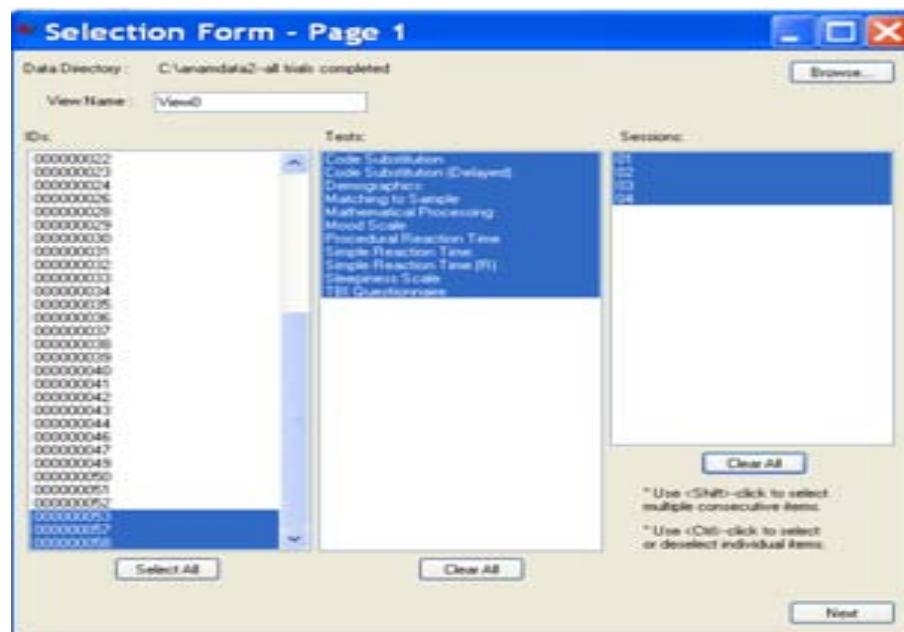
III. SECTION FORM – PAGE 2

1. Choose specific Variables in this order:
    a. Code Substitution – MEANRTCORR; PERCCORR; THROUGHPUT
    b. Code Substitution Delayed- MEANRTCORR; PERCCORR; THROUGHPUT
    c. Matching to sample - MEANRTCORR; PERCCORR; THROUGHPUT
    d. Mathematical Processing- MEANRTCORR; PERCCORR; THROUGHPUT
    e. Mood Scale- MEANRT & "VIGOR, RESTLESSNESS, DEPRESSION, ANGER, FATIGUE
        ANXIETY & HAPPINESS" – Under "Section/ Category" select NUMADJCAT;
        SUMADJCAT; MEANADJCAT; PERCADJCAT; MEANRTADJCAT(all boxes)
    f. Simple Reaction Time- MEANRTCORR; PERCCORR; THROUGHPUT
    g. Simple Reaction Time (R)- MEANRTCORR; PERCCORR; THROUGHPUT
    h. Sleepiness Scale – SUBJRESP

2. Choose "PROCEDURAL REACTION TIME" under 'section/Category'
    a. MEANRTCORR
   b. PERCCORR
    c. THROUGHPUT
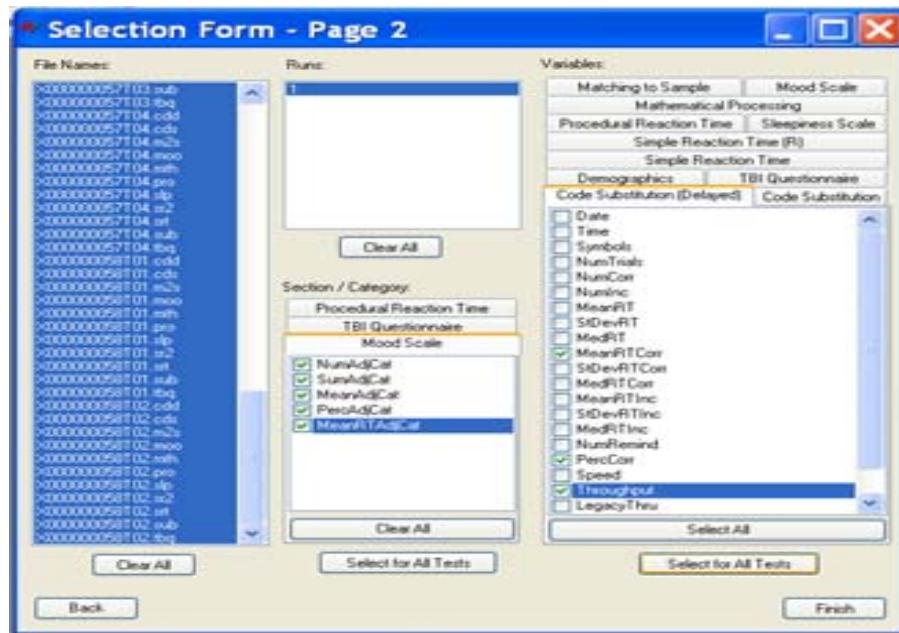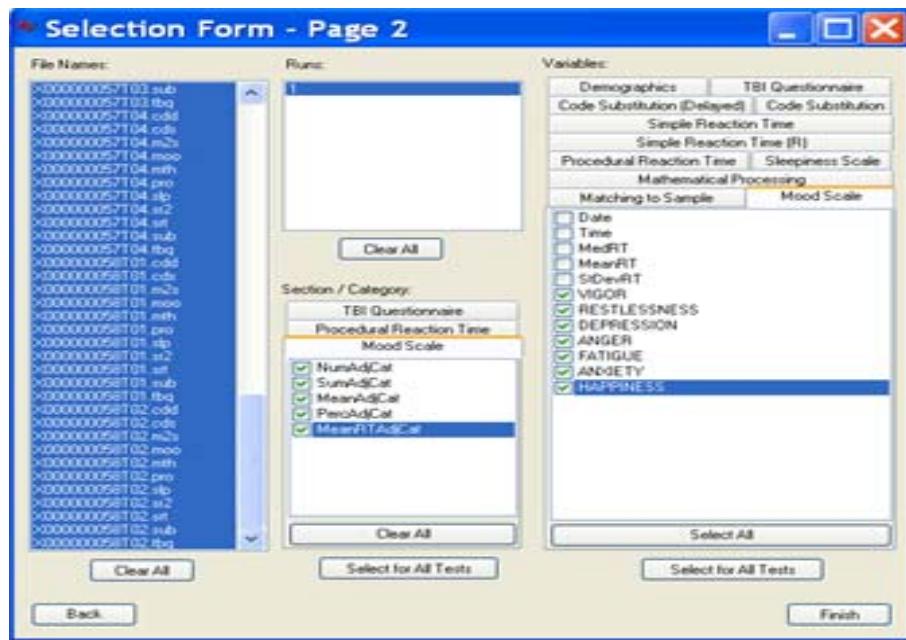
1. Click "FINISH"
2. Pop- up box will appear asking to "PROCEED?"; Click "YES"

IV. PREPARATION FOR EXCEL TRANSFER

1. Click "FILE"
2. Click "EXPORT ALL TEST"
3. Save as "subject ID number and date" (ex. 0053-0058_17SEP09)
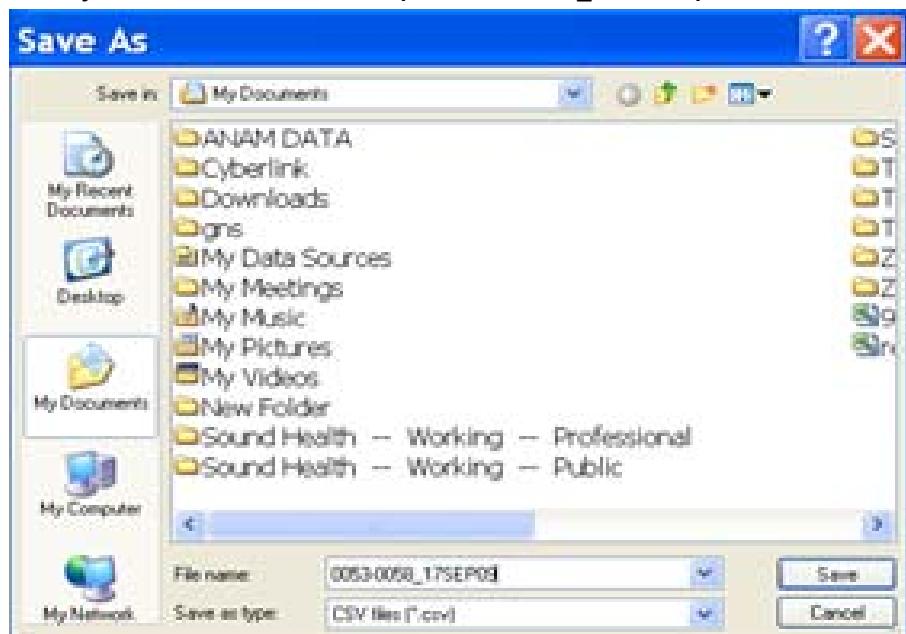
V. EXCEL SPREADSHEET

1. **Open Excel**
2. **Click "DATA"**
3. **Choose "IMPORT EXTERNAL DATA"**
4. **Select "IMPORT DATA"**
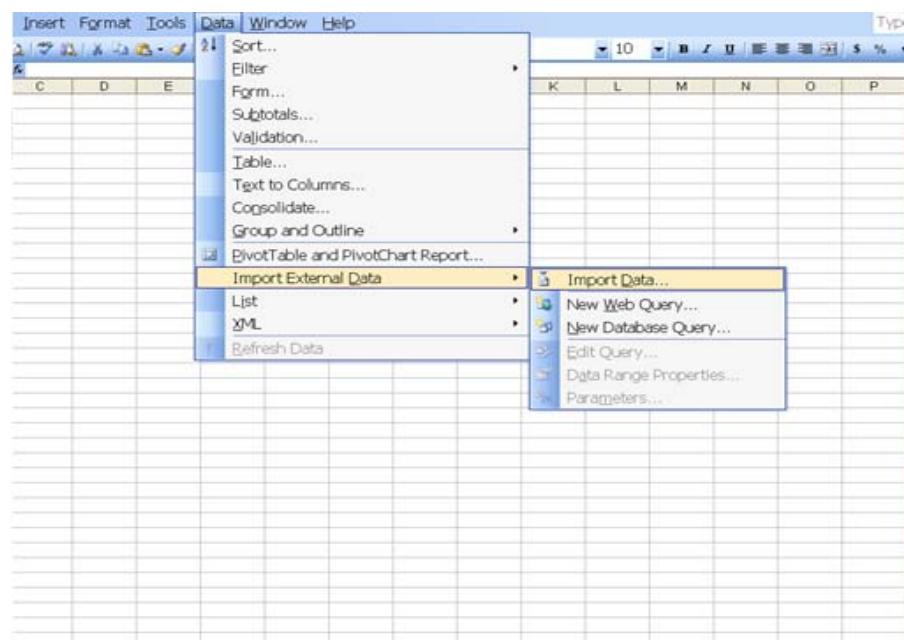
5. **Select data source, choose "MY DOCUMENTS" search for saved data file (0053-0058_17SEP09)**
6. **Click "OPEN"**
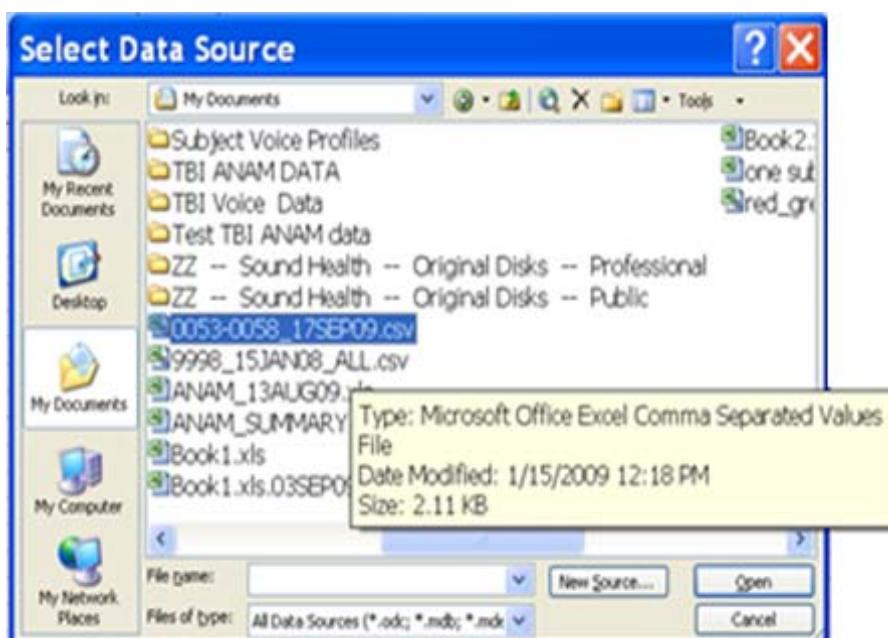
7. **Pop-up box will appear "TEXT IMPORT WIZARD – STEP 1 OF 3"**
8. **Click "NEXT"**

9. **Pop-up box will appear "TEXT IMPORT WIZARD – STEP 2 OF 3"**
10. **Delimiters box choose : "TAB & COMMA"**
11. **Click "NEXT**

12. Click "FINISH"

13. Pop-up "TEXT IMPORT WIZARD – STEP 3 OF 3

14. Pop-up box will appear "IMPORT DATA?" Click "OK

Data now appears in an excel spreadsheet!!

VI. CLEAN UP DATA FOR SPSS TRANSFER

1. **Scroll through excel spreadsheet columns, Delete Column "C = RUN" then highlight repeated columns for "ID, SESSION, RUN" for each variable, right click and delete repeated columns.**

1. **Arrange columns according to this template. Column headings should be in this order prior to transfer to SPSS:**

ID
Session
cds MeanRTCorr
cds PercCorr
cds Throughput
cdd MeanRTCorr
cdd PercCorr
cdd Throughput
m2s MeanRTCorr
m2s PercCorr
m2s Throughput
mth MeanRTCorr
mth PercCorr
mth Throughput
moo MeanRT
moo VIGOR:NumAdjCat
moo VIGOR:SumAdjCat
moo VIGOR:MeanAdjCat
moo VIGOR:PercAdjCat
moo VIGOR:MeanRTAdjCat
moo RESTLESSNESS:NumAdjCat
moo RESTLESSNESS:SumAdjCat
moo RESTLESSNESS:MeanAdjCat
moo RESTLESSNESS:PercAdjCat
moo RESTLESSNESS:MeanRTAdjCat
moo DEPRESSION:NumAdjCat
moo DEPRESSION:SumAdjCat
moo DEPRESSION:MeanAdjCat
moo DEPRESSION:PercAdjCat
moo DEPRESSION:MeanRTAdjCat
moo ANGER:NumAdjCat
moo ANGER:SumAdjCat
moo ANGER:MeanAdjCat
moo ANGER:PercAdjCat
moo ANGER:MeanRTAdjCat
moo FATIGUE:NumAdjCat
moo FATIGUE:SumAdjCat
moo FATIGUE:MeanAdjCat
moo FATIGUE:PercAdjCat
moo FATIGUE:MeanRTAdjCat
moo ANXIETY:NumAdjCat
moo ANXIETY:SumAdjCat
moo ANXIETY:MeanAdjCat
moo ANXIETY:PercAdjCat
moo ANXIETY:MeanRTAdjCat

moo HAPPINESS:NumAdjCat
moo HAPPINESS:SumAdjCat
moo HAPPINESS:MeanAdjCat
moo HAPPINESS:PercAdjCat
moo HAPPINESS:MeanRTAdjCat
srt MeanRTCorr
srt PercCorr
srt Throughput
sr2 MeanRTCorr2
sr2 PercCorr3
sr2 Throughput4
slp SubjResp2

2. **Click "FILE"**
3. **Choose "SAVE AS" then type file name- (EX. 0053-0058_EXCEL_17SEP09)**
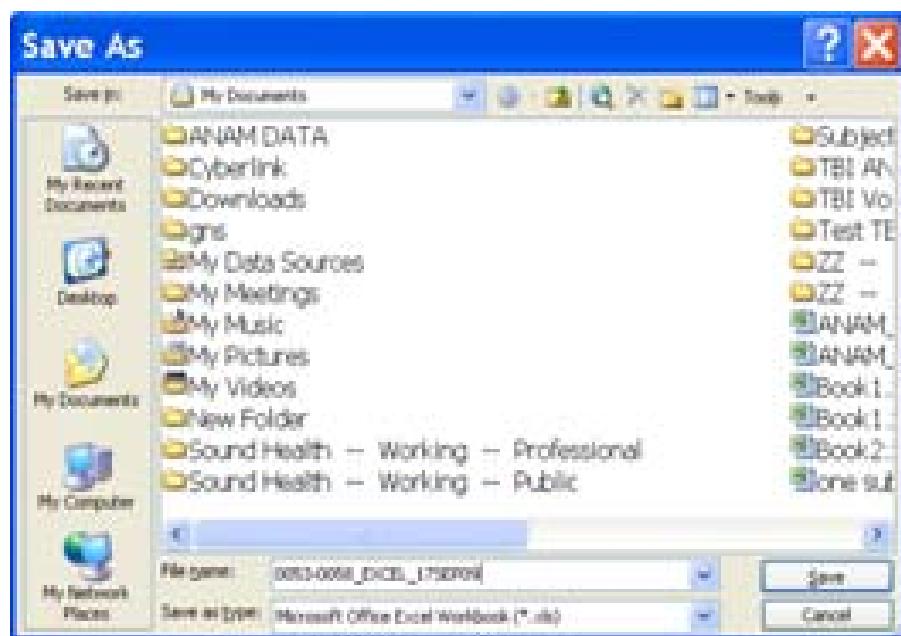
VII. SAVING DATA TO DISC FOR TRANSFER

1. **Double click on "MY DOCUMENTS"**
2. **Right click on final excel worksheet (0053-0058_EXCEL_17SEP09)**
3. **Choose "SEND TO"**
4. **Choose "DVD/CD"**
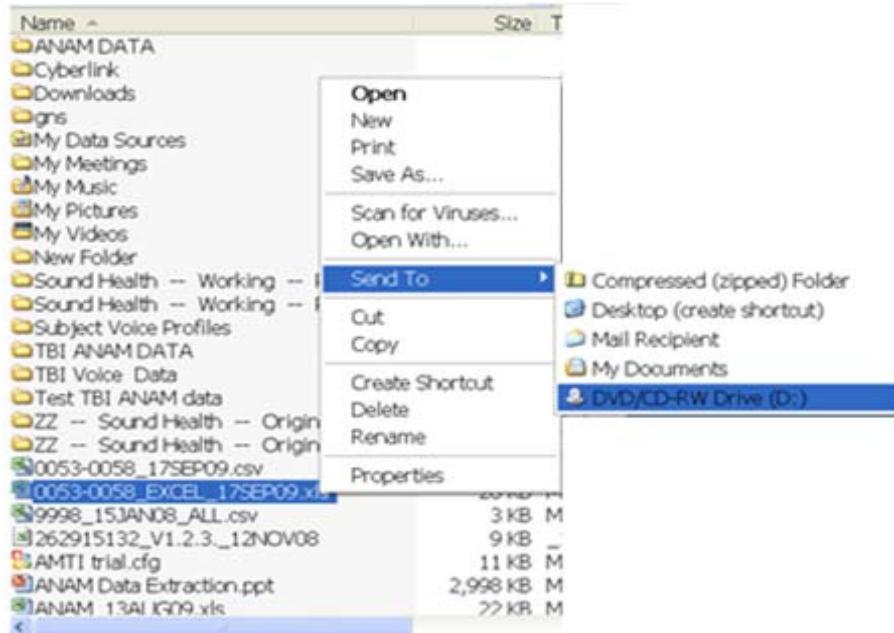
5. Sava data to disc/CD
6. Open disc on desk top computer
7. Open file entitled "ANAM™ DATA" on desk top computer
8. Open CD/Disk
9. Copy and paste data from the CD/Disk to ANAM™ DATA file on DESK TOP; worksheet 1, entitled "ANAM™ ALL DATA"
10. Then individually copy and paste specific visit data results to worksheet 2 in ANAM™ DATA file entitled "SPSS READY"
11. Once complete, Click "FILE"
12. Choose "SAVE AS"
13. Enter in file name: "ANAM™ DATA_ *current date*"
14. Data now ready for SPSS transfer!

List of Symbols, Abbreviations, and Acronyms

ADEPT   ANAM Data Extraction and Presentation Tool

ANAM   Automated Neuropsychological Assessment Metrics

APR   ANAM Performance Report

C-SHOP   Center for the Study of Human Operator Performance

DoD   Department of Defense

IED   improvised explosive devices

LAN   local area network

MS   Microsoft

mTBI   mild TBI

PTSD   Post Traumatic Stress Disorder

SPSS   Statistical Package for the Social Sciences

TBI   Traumatic brain injury

USB   universal serial bus

UTC-PAB   Unified Tri-Service Cognitive Performance Assessment Battery

WAN   wide area network

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